



MATHS

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CHSE ODISHA EXAMINATION PAPER 2020

Group A 10 Marks 1 Answer All Questions

1. A is a square matrix of order 3. write the value n, $|2A| = n|A|$.

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2. A discrete random variable X has the probability distribution as given below:

| | | | | |
|------|-----|-------|--------|---|
| X | 0.5 | 1 | 1.5 | 2 |
| P(X) | k | k^2 | $2k^2$ | k |



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3. Write the differentiate coefficient of $\tan^{-1}\left(\frac{\sin x + \cos x}{\cos x - \sin x}\right)$ with respect to x .



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4. If $f(x) = \sin x + 2$ in the interval $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, what can you say about the greatest value of $f(x)$?



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5. If $\int_{-\frac{1}{2}}^{\frac{1}{2}} \cos x \ln \frac{1+x}{1-x} dx = k \ln^2$ then write the value of k .



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6. Write the differential equation of all non-horizontal lines in a plane.



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7. IF \vec{a} and \vec{b} are unit vectors and $\vec{a} - \vec{b}$ is also a unit vector, then write the angle between \vec{a} and \vec{b}



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8. Write the axis to which the plane $by+cz+d=0$ is parallel.



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9. Write down all the partitions of the set $\{a,b,c\}$.



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10. Write the domain of the function defined by $f(x)=\sin^{-1} x + \cos x$



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Group B 60 Marks 2 Answer Any Three Questions

1. A man plans to start a poultry farm by investing at most ₹ 3000. He can buy old hens for ₹80 each and young ones for ₹ 140 each, but he cannot house more than 30 hens. Old hens lay 4 eggs per week ,each egg sold at ₹5. It costs ₹ 5 to feed an old hen and ₹8 to feed a young hen per week. Formulate his problem determining the number of hens of each type he should buy so as to earn a profit of more than ₹ 300 per week.

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2. Test whether the relation : $R = \{(m, n) : 2 \mid (m + n)\}$ on \mathbb{Z} is reflexive, symmetric or transitive.

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3. Prove that for any $f: X \rightarrow Y$, $f \circ id_x = f = id_y \circ f$.



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4. Solve equation $3\tan^{-1}\frac{1}{(2+\sqrt{3})} - \tan^{-1}\frac{1}{x} = \tan^{-1}\frac{1}{3}$



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5. Prove that $\tan\left(\frac{\pi}{4} + \frac{1}{2}\cos^{-1}\frac{a}{b}\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2}\cos^{-1}\frac{a}{b}\right) = \frac{2b}{a}$



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Group B 60 Marks 3 Answer Any Three Questions

1. Four cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of aces. Calculate the mean and variance of the number of aces.



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2. Find the inverse of the matrix $\begin{bmatrix} 4 & -2 \\ 3 & 1 \end{bmatrix}$



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3. There are two families A and B. There are 4 men, 6 women and 2 children in family A and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women and 1800 for children, and 45 g of proteins for men, 55 g for women and 33 g for children. Represent the above information by matrices. Using matrices multiplication, calculate the total requirement of calories and proteins for each of the 2 families.



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4. Eliminate x, y, z from

$$a = x/y - z, \quad b = y/z - x, \quad c = z/x - y$$



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5. There are 25 girls and 15 boys in class XI and 30 boys and 20 girls in class XII. If a student chosen from a class, selected at random, happens to be a boy, find the probability that he has been chosen from class XII.

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Group B 60 Marks 4 Answer Any Three Questions

1. Show that the tangent to the curve $x = a(t - \sin t)$, $y = at(1 + \cos t)$

at

$t = \frac{\pi}{2}$ has slope $(1 - \pi/2)$

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2. Examine the continuity of the following functions at the indicated

points $f(x) = \begin{cases} 2x + 1 & \text{if } x \leq 0 \\ x & \text{if } 0 < x < 1 \\ 2x - 1 & \text{if } x \geq 1 \end{cases}$ at $x = 0, 1$.



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3. If $\sin(x + y) = y \cos(x + y)$ then prove that

$$\frac{dy}{dx} = -\frac{1 + y^2}{y^2}$$



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4. What is the derivative of $\sec^{-1}\left(\frac{1}{2x^2 - 1}\right)$, with respect to $(\sqrt{1 - x^2})$

?



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5. Find the approximate value of $\sqrt{48.96}$



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Group B 60 Marks 5 Answer Any Three Questions

1. Solve : $\ln\left(\frac{dy}{dx}\right) = 3x + 4y$ given that $y=0$, when $x=0$.

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2. Evaluate $\int \frac{3 \sin x + 28 \cos x}{5 \sin x + 6 \cos x} dx$

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3. Evaluate the following integrals :

$$\int_0^{\pi/2} \log \left| \frac{4 + 3 \sin x}{4 + 3 \cos x} \right| dx.$$

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4. The area between $x = y^2$ and $x = 4$ is divided into two equal parts by the line $x = a$. Find the value of a .

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5. Solve: $x \frac{dy}{dx} + y = y^2 \ln x$



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Group B 60 Marks 6 Answer Any Three Questions

1. Prove that the measure of the angle between two main diagonals of a cube is $\cos^{-1} \frac{1}{3}$.



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2. Prove that the four points with position vectors $2\vec{a} + 3\vec{b} - \vec{c}$, $\vec{a} - 2\vec{b} + 3\vec{c}$, $3\vec{a} + 4\vec{b} - 2\vec{c}$ and $\vec{a} - 6\vec{b} + 6\vec{c}$ are coplanar.



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3. If $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = 2\hat{i} - 3\hat{j} + 4\hat{k}$ then verify that $\vec{a} \times \vec{b}$ is perpendicular to both \vec{a} and \vec{b} .

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4. Passing through the point $(2, -3, 1)$ and $(-1, 1, -7)$ and perpendicular to the plane $x - 2y + 5z + 1 = 0$.

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5. Find the perpendicular distance of the point $(-1, 3, 9)$ from the line

$$\frac{x - 13}{5} = \frac{y + 8}{-8} = \frac{z - 31}{1}$$

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Group C 30 Marks 7 Answer Any One Questions

1. Find the solution of the following differential equations:

$$(4x+6y+5)dx-(2x+3y+4)dy=0$$

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2. Find the area of the smaller region bounded by the ellipse

$$\frac{x^2}{9} + \frac{y^2}{4} = 1 \text{ and the line } \frac{x}{3} + \frac{y}{2} = 1.$$

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3. Evaluate $\int \frac{x^5 + x^4 + x^3 + x^2 + 4x + 1}{x^3 + 1} dx$

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Group C 30 Marks 8 Answer Any One Questions

1. Show that \vec{a} , \vec{b} and \vec{c} are coplanar if $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are coplanar.

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2. Find the shortest distance between the following two lines:

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}, \quad \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$$

Find also the equations of the line of shortest distance.

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Group C 30 Marks 9 Answer Any One Questions

1. Solve the following LPP graphically Optimize $Z = 5x_1 + 25x_2$ subject to $-0.5x_1 + x_2 \leq 2$, $x_1 + x_2 \geq 2$, $-x_1 + 5x_2 \geq 5$, $x_1, x_2 \geq 0$

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2.

If

$\sin^{-1}x + \sin^{-1}y + \sin^{-1}z = \pi$ prove that $x^4 + y^4 + z^4 + 4x^2y^2z^2 = 2(x^2y^2 + y^2z^2 + z^2x^2)$



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3. Show that the operation defined on $(0,1,2,3,4)$ by $a \cdot b = a \times b \pmod{5}$ is a binary operation, Test whether it is associative and commutative. Test whether the identity exists, if the identity exists, investigate about the inverse for each element.



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Group C 30 Marks 10 Answer Any One Questions

1. The probability of a shooter hitting a target is $\frac{3}{4}$ Find the minimum number of times he must fire, so that the probability of hitting the target atleast once is greater than 0.999.



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2. Prove the following:

$$\begin{bmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{bmatrix}$$
$$=(a^2 + b^2 + c^2)(a + b + c)(b - c)(c - a)(a - b)$$

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3. If A,B,C are matrices of order 2×2 each and $2A + B + C = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$

$$A + B + C = \begin{bmatrix} 0 & 1 \\ 2 & 1 \end{bmatrix}$$

$$A + B - C = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix} \text{ find A,B and C.}$$

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Group C 30 Marks 11 Answer Any One Questions

1. If $y = x^{\sin x} + x^3 \frac{\sqrt{x^2 + 4}}{\sqrt{x^3 + 3}}$ find $\frac{dy}{dx}$.



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2. Show that the semivertical angle of a cone of given slant height is $\tan^{-1} \sqrt{2}$ when its volume is maximum.



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